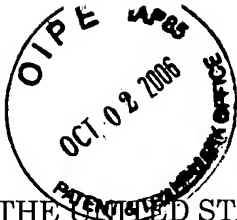


10/805,791



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant (s): Shekarriz et al.

Serial No.: 10/805,791

Group Art Unit: 1724

Filed: March 22, 2004

Examiner: Pham

For: MICROIMPACTOR SYSTEM HAVING OPTIMIZED IMPACTOR SPACING

Hon. Commissioner of Patents & Trademarks

Sir:

DECLARATION OF JOSEPH G. BIRMINGHAM

Joseph G. Birmingham declares as follows:

1. I am an inventor of the subject matter of this application.
2. I reside at 604 W. Evergreen Blvd., Vancouver, Washington, 98660.
3. I am familiar with this application, and have reviewed the office action in this application that was issued on March 29, 2006.
4. I am familiar with the contents of U. S. Patent No. 6,120,573, which has been used to reject the claims in this application. I am an inventor of the invention that is claimed in that patent.
5. I am making this declaration to provide information for the examiner's consideration in evaluating the patentability of the claims of this application with respect to U. S. Patent No. 6,120,573.
6. U. S. Patent No. 6,120,573 describes micropillar arrays. The micropillars are arranged in a two-dimensional array. The intra-row spacing of the micropillars in U. S. Patent No. 6,120,573 is described in Example 1 thereof. This spacing is 2.54 mm, whereas the micropillars have a diameter of 2.04 mm (calculated as 2.54 mm less the 0.5 mm gap

between the micropillars). The intra-row spacing of the micropillars in Example 1 of U. S. Patent No. 6,120,573 is therefore approximately 1.25 times the diameter of the micropillars.

7. The row-to-row spacing of the micropillars in U. S. Patent No. 6,120,573 is not given explicitly. However, an examination of the drawings, particularly Figure 1D, shows that the row-to-row spacing of the micropillars is less than or approximately equal to their average diameter. This is due in part to the irregular shape of the micropillars, which permits the rows of micropillars to overlap somewhat.

8. The experiments described below were run pursuant to an experimental plan devised by me. The results of these experiments, in my opinion, establish an unexpected improvement in performance of microimpactor arrays when the micropillars are spaced apart as described in the claims of this application, compared to microimpactor spacing more akin to that described in U. S. Patent No. 6,120,573.

9. A first experiment evaluated the performance of a microimpactor array having cylindrical microimpactors arranged in a series of six rows. I will refer to this microimpactor array as C-MA, for "Comparative Microimpactor Array". Microimpactors in individual rows were offset and centered with respect to microimpactors in preceding and subsequent rows. The microimpactors on C-MA had a diameter of 0.25 mm and a height of 0.50 mm. The width of each row of microimpactors was 1 cm. The microimpactors were arranged to define an inlet of approximately 0.05 cm in area. The intra-row spacing of the microimpactors on C-MA was equal to the microimpactor diameter, or 0.25 mm. The row-to-row spacing was 0.88 mm, or 3.5 times the microimpactor diameter. Therefore, C-MA had spacing characteristics intermediate to those described in U. S. Patent No. 6,120,573 and those which are the subject of the claims of this application. This spatial relationship is summarized in Table 1 below.

10. C-MA was evaluated by passing an air stream containing 1 micron polystyrene latex particles through C-MA at an inlet velocity of 5 m/s. Pressure drop through C-MA was about 154 Pascals. Under these conditions, approximately 21.1% of the particles were captured by the microimpactor array.

11. For comparison, a second experiment evaluated the performance of a microimpactor array within the scope of the claims of this application. Like C-MA, this microimpactor array had cylindrical microimpactors arranged in a series of six rows. I will refer to this microimpactor array as MA-1. Microimpactors in individual rows were offset and centered with respect to microimpactors in preceding and subsequent rows. The microimpactors on MA-1 had a diameter of approximately 0.20 microns and a height of approximately 0.5 cm. They were arranged to define a roughly square inlet approximately 1 square centimeter in area. The intra-row spacing of the microimpactors on C-MA was equal to 15 times the microimpactor diameter, or 3.75 mm. The row-to row spacing was 2.5 mm, or 10 times the microimpactor diameter. This spatial relationship is summarized in Table 1 below.

12. MA-1 was evaluated in the same manner as was C-MA, at flow rates of from 0.83 to 4.15 L/minute, or slightly less than those used to evaluate CM-A. At all of these operating rates, MA-1 collected approximately 95-100% of the particles introduced with the fluid stream. I do not regard the difference in fluid flow rates to be significant, because MA-1 showed similar collection efficiencies across the entire range of flows from less than 1 to more than 4 L/minute.

13. Table 1 summarizes the characteristics of the microimpactor arrays C-MA and MA-1, and the results that were obtained.

Table 1

	U. S. Patent No. 6,120,573	Current application	C-MA*	MA-1
Intra-row Microimpactor Spacing	~1.25X microimpactor diameter	3-20X microimpactor diameter	1X microimpactor diameter	15X microimpactor diameter
Row-to-row Microimpactor Spacing	~0.8-1.0X microimpactor diameter	3-20X microimpactor diameter	3.5X microimpactor diameter	10X microimpactor diameter
Collection Efficiency			~21%	95-100%

*Comparative Example

14. In my opinion, these results indicate a significant improvement in the performance of microimpactor array MA-1 (an example of the present invention) over that of C-MA (which has a microimpactor spacing akin to that of U. S. 6,120,573). This improvement is due to the optimized spacing of the microimpactors of MA-1, in accordance with this invention.

15. C-MA does not have microimpactor spacing identical to that described in U. S. Patent No. 6,120,573. The microimpactor spacing of C-MA is actually closer to that of the present claims than the spacing described in U. S. Patent No. 6,120,573, in that the row-to-row spacing is within the limits of the present claims. The row-to-row spacing is much smaller in the microimpactor described in U. S. Patent No. 6,120,573. I expect that a microimpactor having the row-to-row spacing described in U. S. Patent No. 6,120,573 would provide even poorer results than those obtained with C-MA.

I hereby declare that all statements made on my own knowledge are true, and all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.


Joseph G. Birmingham

28 Sep 2006
(Date)